

1470 WIZARD Automatic Gamma Counters



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DESCRIPTION

The 1470 WIZARD® counters are a family of automatic, multidetector computer-controlled benchtop gamma counters. One, two, five or ten independent well-type detectors, automatic or manual counting mode, multi-user and multitasking operation environment provide flexible and efficient sample processing.

The instrument is designed to work either as a stand alone CPM counter, stand alone RIA counter or as an integral part of the MultiCalc® laboratory data management system. WIZARD is available in either 550-sample or 1000-sample conveyor versions.

STANDARD FEATURES

- **Detector system** consists of detectors made of thallium activated, sodium iodide crystals of the end-well design. The crystal height is 50 mm (2.0 in.) and diameter 32 mm (1.26 in.). Special counting geometry ensures optimal counting efficiency of sample without the need for manual setting of counting positions.
- **Detector matching** is within $\pm 1\%$ of mean counts of all detectors after normalization.
- **Radiation shielding** is present for the detector assembly and the conveyor. The detector assembly is surrounded by a minimum of 12 mm of lead shielding above and below. The shielding against the conveyor is solid lead 30 mm (1 $\frac{1}{4}$ in.). The shielding between detectors is 7 mm (0.28 in.).

- **Detector to detector crosstalk** from neighboring detectors is eliminated by an exclusive, patented crosstalk correction system.

Detector to detector crosstalk, corrected, worst case

¹²⁵ I	Negligible
⁵⁷ Co	< 0.001%
⁵¹ Cr	< 0.5%
¹³⁷ Cs	< 4%
⁵⁸ Co	< 5%

- **Conveyor to detector crosstalk** resulting from the influence of higher energy nuclides is eliminated by a 30 mm lead shielding against the samples in the conveyor.

Conveyor to detector, single source, worst case

¹²⁵ I	Negligible
⁵⁷ Co	Negligible
⁵¹ Cr	Negligible
¹³⁷ Cs	< 0.12%
⁵⁸ Co	< 0.2%

- **Detector disable (deactivation)** of any detector is possible without the need to arrange the samples in the racks.

- **Sample changer** is a bi-directional automatic conveyor system with a storage capacity of 55 racks (550 samples) or 100 racks (1000 samples).
- **Elevator system** consists of a robotic arm system with cast aluminium grip units.
- **Linear multichannel analyzer** with 1024 channels and a 12-bit analogue/digital converter. Dead time is 5.25 microseconds.
- **Built-in computer** controlling the system is a 16-bit, industry standard computer having a 3.5", 1.44 MB disk drive and a hard disk. The computer contains 1 MB of RAM memory, two serial RS232C ports and a parallel port.
- **Built-in LCD display** includes a black and white liquid crystal display.
- **Alphanumeric keyboard** is an IBM-compatible "AT style" keyboard on a pullout shelf, located immediately underneath the display.
- **Operation keyboard** is a membrane type, touch sensitive keyboard, located immediately underneath the display.
- **Automatic GLP documentation** automatically monitors 9 detector parameters including background, efficiency, resolution, calibration, normalization and Chi-square performance. Automatically evaluates monitored data for quality assurance and provides out-of control warnings. Provides QC documentation to comply with Good Laboratory Practice (GLP) for regulatory agencies.
- **Sample tube specifications** are shown in the table below.

	In Automatic Operation	In Manual Operation
Maximum diameter:	13 mm	15 mm (17 mm without tray)
Maximum cap diameter:	14 mm	22 mm
Minimum diameter:	No limit	No limit
Minimum height:	No limit	No limit
Maximum height:	90 mm (including cap)	120 mm (including cap)
Tube shape:	Microcentrifuge tubes can be used without adapters. A special carrier for Eppendorf tubes is available (maximum diameter 13 mm, check for fit).	

- **Plastic sample racks** can hold 10 samples/rack. Rack dimensions: 164 mm length; 18 mm width; and 57 mm height. Use of an ultrasonic bath instead of machine wash is recommended for cleaning. Maximum temperature: 40 °C. Racks are provided with individual sample carriers that can be replaced in case of contam-

ination and are compatible with most centrifuges. Maximum centrifugation force: 2500 x G.

- **Positive sample rack information** is accomplished by permanently labeling each rack with a bar code, read when the samples in the rack are counted. The label is attached to the rack on a removable clip.
- **Sample ID** is facilitated using two barcodes which can be provided for each rack. Each has the capacity for 2 digits or a special code word.
- **Automatic background correction** is accomplished by automatic subtraction of background counts in each counting region. Complete background spectra are stored.
- **Radionuclide library** consists of 48 nuclides:

¹²⁵ I	⁷⁷ Br	¹³⁷ Cs	¹²³ I	²² Na	⁴⁷ Sc
⁵⁷ Co	¹¹ C	¹⁷¹ Er	¹²⁹ I	⁹⁵ Nb	⁷⁵ Se
⁵¹ Cr	⁴⁷ Ca	¹⁸ F	¹³¹ I	¹⁵ O	⁵³ Sm
⁷⁶ As	¹⁰⁹ Cd	⁵⁹ Fe	¹¹¹ In	²⁰³ Pb	¹¹³ Sn
¹⁹⁵ Au	¹⁴¹ Ce	⁶⁷ Ga	^{114m} In	⁸⁶ Rb	⁸⁵ Sr
¹⁹⁸ Au	⁵⁸ Co	¹⁵³ Gd	⁴² K	¹⁰³ Ru	^{87m} Sr
¹³³ Ba	⁶⁰ Co	⁶⁸ Ge	⁴³ K	¹²⁵ Sb	^{99m} Tc
¹³⁹ Ba	¹³⁴ Cs	²⁰³ Hg	¹³ N	⁴⁶ Sc	²⁰¹ Tl

Open window (15–1000 keV).

The user can customize all nuclide preset values, including the nuclide name and ID number. Dual label counting can use any pair included in the library.

- **Energy range** is 15 keV to 1000 keV.
- **Gain stabilization** in the optimized window setting for each nuclide is based on the use of multichannel analyzer techniques. The stability and reproducibility of the results are ensured by checking resolution, efficiency, spectrum drift and background. Efficiency variation < 0.5% (excluding statistical counting error).
- **Live spectrum display** of counts, CPM or CPS values for all detectors simultaneously can be displayed on the LCD screen. Counting spectrum can be displayed or plotted on the printer. Energy scale is linearity corrected and can be zoomed.
- **Spectrum files** can be automatically saved to hard disk. They can be copied to the data logger diskette or transmitted to another computer. Saved spectra can also be examined off-line with separate software, e.g. Microsoft® Excel.
- **Hard copy** can be printed of screens and protocol contents.
- **Maximum count rate** is 2 million CPM for given error. Higher count rates are possible with reduced accuracy. Dead time error is < 1% to 2 million CPM.

- **Multi-user capability** stores 99 assay protocols which can be called into use automatically with barcode clips.
- **Multitasking operation environment** allows simultaneous protocol editing while counting is in process.
- **Help utility** includes full screen helps available at all stages of operation.
- **Duplicate sample error detection** ensures that any detector efficiency variation is seen immediately. This is possible because duplicate samples are counted in different detectors. This feature is not available in single detector mode.
- **Two simultaneous counting regions** enable two nuclides to be processed simultaneously. Nuclides can be preset or user selected. Spillup and spilldown correction is carried out automatically. Special dual label normalization is not needed.
- **Decay correction** corrects for nuclide decay in both counting regions to any date, time or assay beginning. Decay correction also works in normalization e.g. ^{99m}Tc . Half life values are included in the nuclide library.
- **MultiSTAT interrupt counting** enables a series of stat samples to be processed in manual mode while the assay in process is not affected. There is no need to rearrange the samples on the conveyor.
- **Automatic normalization** is carried out by using a normalization cassette for each defined nuclide. All detectors can be automatically normalized using a single uncalibrated source. Waste radioactivity can be used for any nuclide normalization. No separate normalizations for different volumes are needed.
- **Contamination guards** are inherent in rack construction, protecting the detectors from contamination. Samples are separated from the detectors by liquid tight, disposable sample holders.
- **Decontamination facilities** are freely accessible to the user, including the conveyor, sample changer and detectors at all stages of operation. Decontamination is very fast and easy.
- **Automatic power failure recovery** enables an assay in process to be automatically restarted after power failures of up to 30 days.
- **Date and time** includes battery support for 30 days.
- **Connections** include a serial ASCII interface RS232C, 2 output terminals: a serial printer and a system PC (external MultiCalc) and a parallel printer data connection. Printers must be able to print in MSDOS. They must be Epson compatible or accept PCL Level 3 commands.

- **Programmable computer and printer I/O.** Each RS232C interface port can be individually programmed for data format, baud rate and handshaking mode. All ports can be de-activated.
- **Datalogger** enables all assay results to be automatically stored in MS-DOS ASCII format on 1.44 MB diskettes. Files are transportable, as .TXT files, to popular spreadsheet programs such as Lotus® 1-2-3 or Microsoft Excel.
- **Remote instrument control** via PC port using character-based command language is applicable for some non-PerkinElmer Windows® software as well.

RIACALC WIZ SOFTWARE

RIACalc WIZ software is standard on all WIZARD counters and includes a built-in RIA evaluation and quality assurance program. It supports RIA, IRMA or screening types of assays, single or dual label.

- **Curve fitting techniques** support all usual response calculations such as linear interpolation, linear to cubic regression, either unweighted or weighted, and interpolation or RIA/IRMA model-based spline. Four-parameter logistic fit. X-axis transformations include lin dose, log dose or lin/log dose. Response transformations are either CPM, B/Bo, logit (B/Bo), log(B), B/T, Bo/B or T/B.
- **Assay protocols** (up to 99) are RIACalc RM/DM-compatible. SAVE (to floppy) and LOAD (from floppy) functions are provided. Protocols can be password-protected.
- **Assay recalculation and reevaluation** for assays with erroneous samples can be done without recounting. Full editing is possible for standards, patient samples and controls. Previously saved curves can be used in evaluation.
- **Unknown samples** can include a maximum of 10 dilution groups; each can have individual (maximum 5) replicate groups. Blank subtraction is automatic. Blank samples are either common for standard and unknown samples, common for all unknowns or for same dilution group. Six standard flags.
- **Control samples** can be included in each protocol. Each control file can have a maximum of 12 values. Either individual or average values can be automatically collected, in six levels. Levy-Jennings charts can be plotted after an assay. The maximum number of assays is 50. The maximum number of saved values is $12 \times 6 \times 50 \times 99 = 356,400$. The saved value can be any field; factory setting is concentration. Special view mode is provided.

- **Trend files** enable 12 trends from the 125 assays to be followed. Levy-Jennings chart can be plotted after an assay. Special view mode is provided.
- **Curve editing** can be done during automatic run, before processing unknown samples. Conditional halt, based on to the goodness of fit is provided for automatic entry to the on-screen editor during evaluation.
- **Automatic outlier rejection** of bad standard points can occur according to two different criteria; difference from mean or from standard curve. Halt for curve edit can also be made conditional depending on the number of outliers.
- **Precision profiles and histograms** are generated and plotted after an assay.
- **Result files** format selectable results to be automatically saved onto hard disk. They can be copied to the data logger diskette or transmitted to an external computer with proper software, e.g. MultiCalc.
- **Special assay protocol creation** is supported by RIACalc WIZ for assays such as hepatitis screening, RAST screenings, ratio assays such as T₃ Uptake or ETR, combined assays such as FTI, Chromium Release studies, or RIAs with variable NSB, e.g. Renin.

Available Configurations

CPM Models	Detectors	Sample Capacity
1470-001	1	550
1470-002	2	550
1470-005	5	550
1470-010	10	550
1470-011	1	1000
1470-012	2	1000
1470-015	5	1000
1470-020	10	1000

Options

1221-244	UltraTerm III Terminal Emulator Software for MS-DOS
1224-310	MultiCalc Advanced Data Management Software (requires an external PC)
1409-208	Floor Stand

Typical Performance Data

Background:	
¹²⁵ I	50 CPM
⁵⁷ Co	90 CPM
Typical values at PerkinElmer factory, Turku, Finland. (Background may vary elsewhere due to local conditions.)	
Efficiency:	
¹²⁵ I	82% (typical)
⁵¹ Cr	3.7% (typical)
¹³⁷ Cs	26% (typical)
Efficiency = CPM/DPM x 100%, window 15 keV – 1000 keV	
Energy resolution:	
¹²⁵ I	< 30%
¹³⁷ Cs	< 16% (typical)
Spillover:	
⁵⁷ Co into ¹²⁵ I	< 3% (uncorrected)
Preset regions	< 1% (corrected)

Physical Data

Dimensions:	
Height:	560 mm (22.0 in.)
Width:	550-sample model: 650 mm (25.6 in.) 1000-sample model: 1170 mm (46.1 in.)
Depth:	550-sample model: 770 mm (30.3 in.) 1000-sample model: 650 mm (25.6 in.)
Weight:	550-sample model: approx. 128 kg (280 lb.) 1000-sample model: approx. 140 kg (308 lb.)
Electrical requirements:	115/230 V ± 10% at 50/60 Hz, 200 VA maximum
Environmental requirements:	Temperature range from +15 °C to +35 °C Max. humidity 85%

Electrical Safety Requirements

The design of the instrument is based on the following electrical safety requirements:

EN 50082-1992; EN 50081-1: 1992
EN 61010-1: 1993 (IEC 1010-1)
EN 61000-3-2: 1995 + A1: 1998 + A2: 1998 + A14: 2000
EN 61000-3-3: 1995
EN 61010-1: 2001
UL 61010A-1: 2002 R12.02
CAN/CSA-C22.2 No. 1010.1-92 + A2: 97

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